NANO DIAMOND BATTERY

Modern life is heavily reliable on mobile battery-powered devices affecting daily aspects of our lives, ranging from telecommunication devices to transport vehicles. There is an increasing demand for efficient and cost-effective batteries. Conventional batteries have been riddled with numerous concerns and in the age of increasing consciousness about global warming and waste accumulation, production must be in line with sustainable development principles and processes.

The Nano Diamond Battery (NDB) is a high-power, diamond-based alpha, beta, and neutron voltaic battery that can provide lifelong and green energy for numerous applications and overcome limitations of existing chemical batteries. The NDB acts like a tiny nuclear generator. The power source for the NDB is intermediate- and high-level radio isotopes that are shielded for safety by multiple levels of synthetic diamond. The energy is absorbed in the diamond through a process called inelastic scattering, which is used to generate electricity. The self-charging process will provide a charge for the full lifetime of any device or machine, with up to 28,000 years of battery life.

Since the battery is self-charging and requires only exposure to natural air, any excess charge can be stored in capacitors, supercapacitors, and secondary cells to extend battery life for cellphones, aircraft, rockets, electric vehicles, sensors, and other devices and machinery.

SYSTEM TECHNOLOGIES

Rather than using conventional EV batteries, NDB could be used during the day to power the car; at night when the car is parked, the NDB-powered EV could be plugged into a house where the generated charge could then power the house and any excess could be sold to the grid.

Diamond Nuclear Voltaic (DNV) technology — As a device, DNV is a combination of a semiconductor, metal, and ceramic that has two contact surfaces to facilitate charge collection. Several single units are connected together via conductive channels that are fabricated by deposition of Ni on the side of the DNV to create a +ve and -ve contact of the battery system, which is called DNV stacks. In between these are radioisotopes that, upon decay, will release either an alpha, beta, or neutron radiation. This is then inelastically scattered in the single crystalline diamond (SCD) to generate charges that are collected by the charge collectors.

Every layer of the DNV stack consists of a high-energy output source. This kind of arrangement improves the overall efficiency of the system and provides a multilayer safety shield for the product.

Rapid conversion from radiation to electricity — All radioisotopes are known to produce high amounts of heat. The strategic placement of the source between the DNV units facilitates inelastic scattering originated due to the presence of SCD in the DNV unit. This design prevents self-absorption of heat by the radioisotope and enables rapid conversion to usable electricity.

Thin film structure — The thin-film profile exhibited by NDB allows radiation absorption in the SCD with minimal self-adsorption. Due to its flexible design structure, this technology can take any shape and form in accordance with the application. NDB can be made as big as the application requires, where the minimum size limit is 40 µm.

Nuclear recycle process — Radioactive waste is reprocessed and recycled to enable sustainability and promote a clean energy source in a safe and secure environment.

SAFETY FEATURES

The black box sends out a signal periodically to broadcast its location; however, the availability of the signal is based on the battery that powers it. Currently, limitation in the battery charge of the black box restricts the search time since the location signal will become unavailable once the battery charge runs out. NDB will be able to increase the battery life of the black box, allowing the search party a greater chance of salvage.

Key innovations of NDB are sophisticated safety features covering thermal, mechanical, and radiation safety.

Diamond encapsulator — Radiation safety is achieved through the encapsulation of the DNV using a diamond encapsulator that contains the radiation within the device. The DNV stacks, along with the source, are coated with a layer of polycrystalline diamond, which is known for being the most thermally conductive material and has the ability to contain the radiation within the device. It is also 12 times tougher than stainless steel, making the battery tough and tamperproof.

The nanolayers are made of chromium and lead in a "hole and cap" structure that captures radiation from the DNV. The hole acts as a thermal conduction channel that conducts heat to the outer portion of the encapsulator. While the cap captures the radiation that comes out of the hole built into the diamond encapsulator component of NDB, it can absorb and contain secondary radiation as well as the primary radiation close to background radiation levels.

Built-in thermal vents — The high energy source present in the battery system produces heat during operation. This leads to thermal conduction in the system. Thermal vents in the system help conduct this process with respect to the outer surface of the diamond to keep the interiors at an optimum level.

Boron-doped SCD — To utilize every aspect in the system, NDB — in addition to alpha and beta — also incorporates the use of neutron radiation with boron-10 doping. Doping helps to convert the extra neutron into alpha ray.

Lock-in system — Using a nuclear power source for a battery system brings up the question of nuclear proliferation due to production of fissionable isotopes such as Pu-238 and U-232. To tackle this issue, NDB uses an ion implantation mechanism, called a "lock-in system," that prevents usage other than power generation. This increases usability by meeting consumer safety requirements.

APPLICATIONS

Automotive — Electric vehicles have been heavily promoted by various governments and as such, it is one of the fastest-growing fields in recent years. Naturally, its key component — the battery that propels the vehicle — has also been heavily developed. As a battery solution, NDB powers the traditional aspects of the car as well as the motors. What is perhaps the most interesting is that innovations such as heads-up displays, augmented reality, self-driving, and onboard AI could also be supported using the NDB.

NDB could be used during the day to power the car; at night when the car is parked, the NDB-powered EV could be plugged into a house where the generated charge could then power the house and any excess could be sold to the grid. This effectively means that the national grid is crowd-sourcing electricity, alleviating the increased electricity demand that comes with the increased adoption rate of EVs.

Aerospace — The aviation market is vast and many of the technological advancements come from the digital revolution. Some examples of NDB's use include securing essential power to areas such as the cockpit to improve airline safety and powering of the black box to aid in salvage of missing aircraft. The black box sends out a signal periodically to broadcast its location; however, the availability of the signal is based on the battery that powers it. Currently, limitation in the battery charge of the black box restricts the search time since the location signal will become unavailable once the battery charge runs out. NDB will be able to increase the battery life of the black box, allowing the search party a greater chance of salvage.

The International Space Station and astronauts' spacesuits could both be powered by NDB. (NASA)

Recent advances in space technology and the rise of electric aircraft have led to increasing demand on their battery systems, hindered by concerns regarding longevity and safety. Satellites and space vehicles rely heavily on solar power, which can be disrupted by harsh space environments.

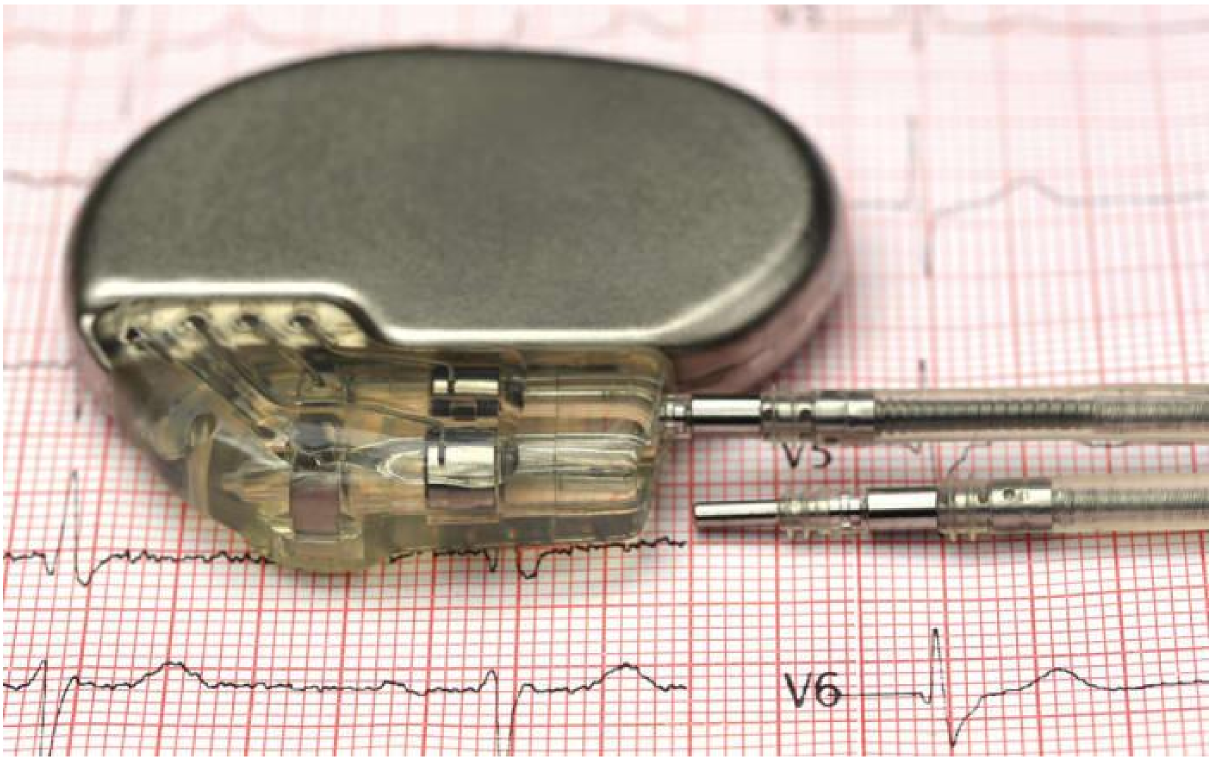
NDB can be utilized to power drones, electric aircraft, satellites, space rovers, spacesuits, and stations while allowing for longer activity.

Medical Technology — In-situ medical devices and implantables such as hearing aids and pacemakers can benefit from long battery life in a smaller package with the added benefit of safety. With NDB, patients no longer have to worry about recharging a pacemaker due to its long half-life. Since NDB has a layer of native radiation absorber integrated into its structure, it prevents radiation leak from implantable devices.

Industrial — NDB's safety, power output, and universality provide power to many routine applications and to those that are difficult to implement. Data centers, remote locations, and hostile environment applications of NDB make it an outstanding promise for productivity and futuristic applications.

One shortfall of the Internet of Things (IoT) is in the physical devices themselves. Since each function (such as lighting) will need sensors and Wi-Fi connectivity receivers, they inevitably will need electricity. Traditionally, this has been satisfied by the use of batteries and direct electrical wiring but in either case, there are limitations — batteries will run flat and wires require an electrician to set up, which could be inconvenient. If an NDB was used, the IoT devices would be fully wireless and could be placed anywhere without the need to worry about the battery depleting.

CONCLUSION



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NDB is green as it has no emission, it is inert to the environment, and does not require cobalt mining. NDB is a more energy-dense, longer-lasting, weather-independent alternative to traditional energy sources. The added values are lack of harmful byproducts and recycling of nuclear waste.

The technology has the potential to replace other energy sources such as gasoline and lithium-ion batteries, reducing their negative environmental impacts caused by emission and toxic metal waste products.

Another trend is the shortage of cobalt, a crucial component of Li-ion batteries. Since the NDB does not contain cobalt, it is a solution that is not affected by the supply shortage of its raw material.

Finally, one of the most important recent trends is the sudden increase in demand for electric vehicles. Governments around the world are working towards shifting the fossil fuel-powered vehicle to electric vehicles — a market that is a natural fit for NDBs.

GENERALLY ASKED QUESTIONS

Q1. WHAT ARE THESE NANO DIAMOND BATTERIES?

ANS1.

Basically, these are the batteries which use nuclear waste produced from the power plants for the production of energy. The nuclear waste is stored in a synthetic diamond structure in which it will slowly decay and release high energy electrons which will provide the energy required. The diamond shape is used because it has been found by the research that it is the most efficient in the energy production.

Q2. WHAT IS THE WORKING PRINCIPLE BEHIND THESE BATTERIES?

ANS2.

The nuclear waste is mostly due to the moderators which are used in the power plant and is made up of the graphite. This carbon 14 nucleus gets decayed into harmless nitrogen 14 with anti-neutrino and high energy electrons. These high energy electrons are further used for the production of the energy by bombarding against the synthetic diamond structure.

Q3. WHAT IS THE REQUIREMENT OF THIS TECHNOLOGY AS MANY OTHER CLEAN RESOURCES ARE PRESENT? (ADVANTAGES)

ANS3.

Even though we have many green energy sources such as wind energy and solar energy but they are very less efficient in respect to the amount of the investment we have to make for their use. On the other hand, nuclear power plants which are much more efficient and clean. But there is a draw back with them that they produce nuclear waste. But with these batteries the nuclear waste could also be recycled and which would be beneficial for the planet. Also these batteries have zero impact on environment and do not contribute to global warning and environmental contamination.

Q4. ARE THEY SAFE? WHY ARE THEY CONSIDERED TO BE A CLEAN SOURCE?

ANS4.

Yes, they are safe. They will be designed using one of the hardest materials, so that there are literally no chances of tempering in them. Radioactive cores are protected by multiple layers of synthetic diamonds, which are exceptionally hard and terribly conductive material. They are considered as the clean source as they are recycling our radioactive waste and all other electronic waste that we produce today .

Q5. ARE THERE ANY FLAWS IN THIS TECHNOLOGY? (DISADVANTAGES)

ANS5.

The flaws are the chances of error in them like we saw in the Samsung batteries. Such things would be hazardous as they contain radioactive material .

Secondly, the approval from the government have to made , so that these can be made for public use , which will be tough task .

Thirdly, making sure that no one make wrong use of them.

Q6. IS THERE ANY PROTOTYPE MADE? WILL COMPANY SURVIVE?

ANS6.

Yes, a prototype has also been made in which an unstable isotope of nickel has been used whose lifespan is of 100 years.

Also the thing is that these are very inexpensive at as it is only one time investment so companies might need to fight for the survival and the might charge on the monthly basis like Netflix subscription.

Q7. IN WHICH AREAS IT WILL BE USED?

ANS7.

They have a very vast application including Automobile sector, medical devices, Defence sector, Aerospace sector, Electronics and much more. They can be used in the implantable medical devices such as pacemakes , in the batteries of our laptops and phone , in defence surveillance . Space crafts are designed which can be powered by batteries.

-DHRUV TYAGI